

Structure and Properties of Cation Exchange Membrane made of Sulfonated Polyethersulfone

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ABSTRACT

In this work a new process was developed for the sulfonation of the chemically stable engineering polymer polyethersulfone as membrane materials for electro dialysis or a flow battery applications. Commercially available polyethersulfone polymer was partially sulfonated using a CSA sulfonating agent in a dichloromethane solvent, which sulfonated polyethersulfone with various sulfonation levels have been prepared. Sulfonated polyethersulfone (SPES) membranes with different ion capacities were prepared for the purpose of identifying cation exchange membrane properties, in an attempt to find a low cost replacement for Nafion, which most of the perfluorinated membranes, known to exhibit a prolonged service life, are expensive and difficult to process. The following features were determined: the degree of sulfonation, water uptake, thermal analysis, and electrochemical properties such as ion exchange capacities, resistivity, selectivity of ion permeation. The surface of the cation exchange membranes, decomposed with the H₂O₂-treatment, were observed by using scanning electron microscope. The area resistivities of SPES membranes in 5N-NaOH decreased from 2,150 Ω-cm² to less than 15Ω-cm² as the ion exchange capacity (IEC) increased from 0.62 to 1.73 milliequivlants per dry gram(meq/dg).